

REMARKS

The Applicants sincerely appreciate the thorough examination of the present application as evidenced by the Office Actions of February 14, 2005, and April 18, 2005. In response, the Applicants have amended Claims 1, 15, and 33 to more clearly define the claimed invention; canceled Claims 24-32; and added new Claims 42-44. In the following remarks, the Applicants will show that all claims are patentable over the cited art. A Notice of Allowance is thus respectfully requested in due course.

I. Claims 1 And 15 Are Patentable Over Narwankar And Lin

Independent Claims 1 and 15 have been rejected under 35 U.S.C. Sec. 102(b) as being anticipated by U.S. Patent No. 6,475,854 to Narwankar *et al.* ("Narwankar"), and under 35 U.S.C. Sec. 102(e) as being anticipated by U.S. Patent Publication No. 2003/0107076 to Lin *et al.* ("Lin"). The Applicants respectfully submit that Independent Claims 1 and 15 are patentable over Narwankar and Lin for at least the reasons discussed below.

For example, Claim 1 recites a method for fabricating a semiconductor device, the method including:

- forming a first conductive layer for a first electrode on a semiconductor substrate;
- forming a dielectric layer on the first conductive layer;
- forming a second conductive layer for a second electrode on the dielectric layer;
- after forming the dielectric layer and after forming the second conductive layer, removing portions of the second conductive layer and portions of the dielectric layer thereby exposing portions of the first conductive layer previously covered by the dielectric layer; and
- performing a thermal process on the second conductive layer and the dielectric layer at a temperature of at least about 400°C.

A. Claims 1 and 15 Are Patentable Over Narwankar

With respect to Narwankar, the Office Action cites bottom Ru electrode 910 as a first electrode on a semiconductor substrate, Ta₂O₅ memory cell dielectric 912 as a dielectric layer, and Ru top electrode 915 as a second electrode. As shown in Figures 9g and 9h of Narwankar, however, portions of the Ta₂O₅ memory cell dielectric 912 are not removed after forming the Ru top electrode 915. Accordingly, Narwankar fails to teach or suggest removing portions of a dielectric layer after forming a second conductive layer on the dielectric layer. As further shown in Figures 9g and 9h, portions of the bottom Ru electrode 910 are not exposed after forming the

Ta₂O₅ memory cell dielectric 912 or the Ru top electrode 915. Accordingly, Narwankar also fails to teach or suggest removing portions of a second conductive layer and portions of a dielectric layer thereby exposing portions of a first conductive layer.

B. Claims 1 And 15 Are Patentable Over Lin

With respect to Lin, the Office Action cites storage electrodes 76 as a first electrode on a substrate, capacitor dielectric film 78 as a dielectric layer, and ruthenium film 80 as a second electrode. As shown in Figures 14 and 15 of Lin, however, portions of storage electrodes 76 are not exposed after forming the capacitor dielectric film 78 or the ruthenium film 80. Accordingly, Lin fails to teach or suggest removing portions of a second conductive layer and portions of a dielectric layer to thereby expose portions of the first conductive layer.

C. Claims 1-23 And 42-43 Are Patentable

For at least the reasons discussed above, the Applicants respectfully submit that Claim 1 is patentable over Narwankar and Lin. In addition, Claim 15 is patentable for reasons similar to those discussed above with respect to Claim 1. Moreover, Dependent Claims 2-14 and 16-23 are patentable at least as per the patentability of Claims 1 and 15 from which they depend. Reinstatement and allowance of previously withdrawn Claims 2, 5-8, 16-17, 19-20, and 42-43 is respectfully requested as these claims depend from allowable independent claims.

II. Claim 33 Is Patentable Over Lin, Narwankar, And Kunitomo

Independent Claim 33 has been rejected under 35 U.S.C. Sec. 102(e) as being anticipated by Lin, under 35 U.S.C. Sec. 103(a) as being unpatentable over Narwankar in view of U.S. Patent No. 6,235,572 to Kunimoto et al. ("Kunimoto"), and under 35 U.S.C. Sec. 103(a) as being unpatentable over Lin in view of Kunimoto. The Applicants respectfully submit, however, that Claim 33 is patentable over Lin, Narwankar, and Kunimoto for at least the reasons discussed below.

As amended, Claim 33 recites a method for fabricating a semiconductor device, the method including:

- forming a first conductive layer for a first electrode on a semiconductor substrate;
- forming a seed layer on the first conductive layer;
- crystallizing the seed layer;

forming a tantalum oxide layer on the crystallized seed layer;
forming a second conductive layer for a second electrode on the tantalum oxide layer;
after forming the tantalum oxide layer and after forming the second conductive layer, removing portions of the second conductive layer and portions of the tantalum oxide layer thereby exposing portions of the first conductive layer previously covered by the tantalum oxide layer; and
performing a thermal process to reduce an interface stress between the second conductive layer and the tantalum oxide layer and to cure the tantalum oxide layer.

A. Claim 33 Is Patentable Over Lin

With respect to the rejection that Claim 33 is anticipated by Lin, the Office Action cites storage electrodes 76 as a first conductive layer for a first electrode on a substrate, capacitor dielectric film 78 as a tantalum oxide layer, and ruthenium film 80 as a second conductive film for a second electrode. As shown in Figures 14 and 15 of Lin, however, portions of storage electrodes 76 are not exposed after forming the capacitor dielectric film 78 or the ruthenium film 80. Accordingly, Lin fails to teach or suggest removing portions of a second conductive layer and portions of a dielectric layer to thereby expose portions of the first conductive layer. In addition, the Office Action states at page 16 that Lin "does not disclose the method of forming the dielectric layer by the method of depositing a seed layer on the first conductive layer, and crystallizing the seed layer." Accordingly, the Applicants respectfully submit that Lin fails to teach or suggest the recitations of Claim 33.

B. Claim 33 Is Patentable Over The Combination Of Narwankar And Kunitomo

With respect to the rejection that Claim 33 is unpatentable over Narwankar in view of Kunitomo, the Office Action cites bottom Ru electrode 910 of Narwankar as a first conductive layer for a first electrode on a semiconductor substrate, Ta₂O₅ memory cell dielectric 912 of Narwankar as a tantalum oxide layer, and Ru top electrode 915 of Narwankar as a second conductive layer for a second electrode. As shown in Figures 9g and 9h of Narwankar, however, portions of the Ta₂O₅ memory cell dielectric 912 are not removed after forming the Ru top electrode 915. Accordingly, Narwankar fails to teach or suggest removing portions of a tantalum oxide layer after forming a second conductive layer on the tantalum oxide layer. As further shown in Figures 9g and 9h of Narwankar, portions of the bottom Ru electrode 910 are not exposed after forming the Ta₂O₅ memory cell dielectric 912 or the Ru top electrode 915.

Accordingly, Narwankar also fails to teach or suggest removing portions of a second conductive layer and portions of a dielectric layer thereby exposing portions of a first conductive layer.

Kunitomo fails to provide the claim recitations discussed above as missing from Narwankar. For example, portions of the lower electrode 54 of Kunitomo are not exposed after forming the tantalum oxide film 55 or after forming the crystallized tantalum oxide film 56. Accordingly, the combination of Narwankar and Kunitomo fails to teach or suggest removing portions of the second conductive layer and portions of the tantalum oxide layer thereby exposing portions of the first conductive layer previously covered by the tantalum oxide layer as recited in Claim 33. Claim 33 is thus patentable over the combination of Narwankar and Kunitomo.

C. Claim 33 Is Patentable Over The Combination Of Lin And Kunitomo

With respect to the rejection that Claim 33 is unpatentable over Lin in view of Kunitomo, the Office Action cites storage electrodes 76 of Lin as a first conductive layer for a first electrode on a substrate, capacitor dielectric film 78 of Lin as a tantalum oxide layer, and ruthenium film 80 of Lin as a second conductive film for a second electrode. As shown in Figures 14 and 15 of Lin, however, portions of storage electrodes 76 are not exposed after forming the capacitor dielectric film 78 or the ruthenium film 80. Accordingly, Lin fails to teach or suggest removing portions of a second conductive layer and portions of a dielectric layer to thereby expose portions of the first conductive layer.

Kunitomo fails to provide the claim recitations discussed above as missing from Lin. For example, portions of the lower electrode 54 of Kunitomo are not exposed after forming the tantalum oxide film 55 or after forming the crystallized tantalum oxide film 56. Accordingly, the combination of Lin and Kunitomo fails to teach or suggest removing portions of the second conductive layer and portions of the tantalum oxide layer thereby exposing portions of the first conductive layer previously covered by the tantalum oxide layer as recited in Claim 33. Claim 33 is thus patentable over the combination of Narwankar and Kunitomo.

D. Claims 33-41 And 44 Are Patentable Over

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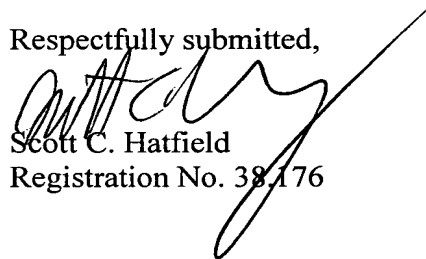
Narwankar, Lin, and Kunitomo And Combinations Thereof

For at least the reasons discussed above, the Applicants respectfully submit that Claim 33 is patentable over Narwankar, Lin, Kunitomo, and combinations thereof. Moreover, Dependent Claims 34-41 are patentable for at least as per the patentability of Claim 33 from which they depend. Reinstatement and allowance of previously withdrawn Claims 34-35 is respectfully requested as these claims depend from an allowable independent claim.

CONCLUSION

Accordingly, the Applicants submit that all pending claims in the present application are in condition for allowance, and a Notice of Allowance is respectfully requested in due course. The Examiner is encouraged to contact the undersigned attorney by telephone should any additional issues need to be addressed.

Respectfully submitted,


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